GB - Translation of EP 404 768 B1 (88P1137)

PATENTS ACT 1977

and

PATENTS (AMENDMENT) RULES 1987

I, Derek Ernest LIGHT, B.A., B.D.Ü.,
translator to Randall Woolcott Services plc of Europa House, Marsham Way, Gerrards Cross, Buckinghamshire, England, hereby declare that I am conversant with the German and English languages and that to the best of my knowledge and belief the accompanying document is a true translation of the text on which the European Patent Office intends to grant or has granted European Patent No. 0,404,768
in the name of Siemens Nixdorf Informationssysteme AG

Signed this 8th day of July 1992

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The invention relates to a depositing device for the, optionally laterally offset, stacking of sheet-form recording carriers in a delivery bay of a printing device in accordance with the precharacterising clause of Patent Claim 1.

The higher the printing output of a printing device for sheet-form recording carriers, the greater the emphasis which is placed upon stacking the printed recording carriers neatly and satisfactorily in the delivery bay. Many measures are therefore known which aim to align the recording carriers to be deposited in relation to an edge or wall of the delivery bay, including by exploiting their transport speed and their own weight.

In specific applications, in high-performance printing devices, for example electrophotographic printers, a plurality of print jobs are handled in continuous operation one after the other. A fundamental feature of a print job for the organisation of the printing operation is that the quantity of printed recording carriers to be assigned in each case to an individual print job has, in fact, to be further handled. This means that recording carriers assigned to different print jobs have to be separated from one another at the delivery station of the printing device, in order to be separately bundled, packed or otherwise further handled.

Modern high-performance printers yield printed matter in a quantity and at a speed which make it appear unreasonable for the operating staff to perform the task of separating the deposited stacks of printed recording carriers into the individual print jobs without any additional aids whatsoever.

Where the printing capacity is relatively low, the printing process could in each case be interrupted without any great loss of output following the conclusion of a print job, the stack of recording carriers assigned to this print job could be removed from the delivery bay and the printing process subsequently resumed. The relatively convenient control systems for modern printing

devices readily allow an automatic stoppage of this kind, but any such job-related print delivery in a start- stop operation would be linked to an increasingly high productivity loss as the nominal output of the printing device increases.

High-performance printers entail a large investment, in which case a start/stop operation of this type could not be justified. Every effort must therefore be made to aim for a continuous printing operation at the nominal output of the printing device. High-performance printers are equipped, for example, with a plurality of feed bays and the assigned printer control system could automatically regulate alternate access to these feed bays. It would therefore be conceivable to mark individual print jobs in the deposited stack of printed recording carriers by means of marked inserts. If a solution of this kind were adopted, a continuous operation would certainly be possible, but such a solution would require a separate feed bay for the said inserts. Moreover, the operating staff would still need to fan out removed stacks of printed recording carriers individually in order to separate different print jobs with the aid of the inserts.

The present invention is based therefore on the consideration that the information on the current status of the printing operation, including, in particular, on the completion of a print job, is held in the printer control system. Using this information, the depositing process can therefore be regulated such that the separation of different print jobs is made easier for the operating staff, as is documented by the prior art.

For instance, US-A-4,017,066 and US-A-4,687,193 disclose depositing devices which enable sheet-form recording carriers to be stacked optionally in left-flushing or right-flushing arrangement in a depositing bay, this stacking method often being termed as 'job staggering'.

The depositing device according to US-A-4,017,066 exhibits, as feeding means, inter alia, a pair of paddle wheels acting upon the sheet stack and being pivotably disposed in a plane running parallel to the sheet stack. The two paddle wheels and other feeding and alignment means are jointly powered by means of belt drives. The two basic alignment means in this case, the paddle wheels, are therefore continuously powered, which has the advantage that the drive system does not have to be constantly switched on and off during running operation. A drawback however is that the paddle wheels have therefore to be jointly adjusted. For this purpose, relatively large weights have to be moved upon every pivotal movement. For kinematic reasons, this solution therefore appears suited only to relatively low-performance printers. In addition, the known device continues to require additional powered alignment elements which act upon the recording carriers along their side edge or on the front face.

The depositing device known from US-A-4,687,193 avoids these difficulties by using alignment means which can be reciprocally alternately activated.

For this purpose, it exhibits as alignment means two individually powered feed elements, assigned respectively to one of the front-face corners of the depositing bay, in the form of paddle wheels. The drive axles of these paddle wheels are rigidly fastened by supporting members to a coverplate of the depositing bay. The twin-vaned paddle wheels are in each case secured at an oblique angle on the drive axle. The recording carrier is thus gripped twice by the paddle wheel during each revolution of the drive axle, which paddle wheel is thereby distorted, due to the varying angle of attack, into a different shape. The force component transmitted onto the recording carrier thus points in the direction of the front wall or, otherwise, essentially in the direction of the assigned side wall of the depositing bay.

The rigid arrangement of the feed elements does however have certain disadvantages. The two feed elements must be individually powered or, in the case of a common drive, alternately actuated by means of couplings. Moreover, the structural design of the feed elements in terms of the choice of material and spatial formation and arrangement is not uncritical for the correct coordination of the corresponding force components in the working directions disposed at an angle of around 90° to each other. Finally, there is the added point - and this applies also to the above-evaluated depositing device according to US-A-4,017,066 - that, using the known depositing device, only a certain size of sheet-form recording carrier can be processed.

The object of the present invention is therefore to refine a depositing device of the type specified in the introduction, automatically regulated by the printer control system, such that it is suitable for use in connection with a high-performance printer and, though of simple technical construction, nevertheless functions reliably in this performance range.

This object is achieved according to the invention in respect of a depositing device of the type specified in the introduction by the features described in the characterising part of the main claim.

This solution also aims to stack the printed recording carriers in the delivery bay in each case in job-staggered arrangement. This lateral stagger, considered in absolute terms, does not need to be very great. It is sufficient for it to be dimensioned such as to enable the different print jobs to be more easily separated by hand. The solution according to the invention for depositing sheet-form recording carriers with a certain lateral stagger breaks away from the notion that it is necessary with separate devices or at least in separate stages to transport the recording carrier to be stacked, on the one hand, in the direction of the front wall of the depositing bay and, on the other hand, in the

direction of a side wall. It shows that it is possible, using a single pair of feed elements, to stack the recording carriers feeding into the depositing bay optionally in left-flushing or right-flushing arrangement and such that they lie neatly against the front wall of the depositing bay.

It is also possible, in the case of a common drive system, to engage these feed elements alternately with the recording carrier, so that the feed element which is in each case deactivated cannot in any way obstruct the depositing process, since, in the deactivated state, it is raised from the recording carrier stack. The reciprocal selection of the two feed elements is simply achieved, thereby providing reliable depositing combined with simple technical construction, even in connection with high-performance equipment, this reliable depositing enabling disturbance-free depositing of recording carriers arriving at high transport speed and in rapid succession.

The flexibility of the underlying construction principle is demonstrated by advantageous designs described in subclaims. In particular, the refinements described in Patent Claims 10 and 11 illustrate that the solution according to the invention can be used without difficulties even in respect of depositing devices which can be easily and quickly converted to different paper sizes.

Further advantages and details of refinements of the invention, which are characterised in the subclaims, emerge also from the following description of an illustrative embodiment which is explained in greater detail on the basis of the drawing, in which:

Fig. 1 shows, in diagrammatic form, a top view of a depositing bay exhibiting, adjacent to the corners of the depositing bay, two alignment units which, reciprocally actuated, stack the recording carriers such that they are laterally offset.

Fig. 2 shows, in a three-dimensional representation, a different view of one of these alignment units.

In Fig. 1, a delivery bay of a printing device is diagrammatically characterised by a front wall 1 and by two side walls 2 or 3. Sheet-form recording carriers 4 feed into this delivery bay in a direction of transport indicated by an arrow 5 and are deposited flush with the front wall 1. In the corners of the delivery bay formed by the front wall 1 and one of the side walls 2 or 3, there are disposed, adjacent to the front face, two alignment units 6, which, having essentially an identical shaping, are disposed in mirror symmetry to one another in relation to the direction of transport 5. It is sufficient therefore to describe one of the two alignment units 6 in detail.

For this purpose, one of the corners of the delivery bay, formed by the front wall 1 and the side wall 2, is shown in three-dimensional representation in Fig. 2. A stack of sheet-form recording carriers 4 which have already been deposited is shown diagrammatically. Across the surface of this stack of printed recording carriers 4, there is disposed parallel thereto, mounted in the side wall 2, an axle 7.

The alignment unit 6 represented in Fig. 2 essentially comprises a cranked supporting member 8 having a middle section 9, having a bearing eye 10 joined in cranked arrangement to one side of the middle section 9, and having a U-shaped fork 11 acting upon the other end of the middle section 9 and cranked, in turn, in the direction of the front wall 1. The supporting member 8 is mounted in rotatably movable manner on the axle 7 by means of the bearing eye 10, as will yet be explained in further detail. A vane wheel 12 is secured laterally, in rotatably movable manner, to the middle section 9. This vane-wheel 12 exhibits a plurality of vanes 13 which are disposed regularly on its periphery and protrude radially outwards. These vanes 13 are elastically configured and form the alignment elements for the recording carriers 4.

In Fig. 2, it is indicated that the vane-wheel 12 circulates in anti-clockwise direction, the vane-wheel being connected to a power take-off roller 14 which sits on the outside of the vane-wheel. In frictional connection with the power take-off roller 14, there is a self-enclosed drive belt 15, which is powered, for its part, by a drive roller 16 which is pushed, directly adjacent to the bearing eye 10 of the supporting member 8, onto the axle 7. This axle 7 forms not only the supporting element for the entire alignment unit 6, but at the same time, as indicated by an arrow 17, a constantly rotating drive shaft. It exhibits, preferably, an edged profile. The drive roller 16 possesses, as a holding fixture, a central recess having a corresponding counter-profile and is thus rotatably coupled to this drive shaft 7. Even though details of this are not represented in Fig 2, the bearing eye 10 of the supporting member 8 is mounted in rotatably movable manner on this drive shaft, so that it is not driven along by this rotating shaft.

The drive of the drive shaft 7 or of the drive roller 16, running in the same direction as the direction of transport 5 of the recording carriers, is converted in the vane-wheel 12 into a feed direction for the recording carriers 4 pointing in the direction of the corner of the delivery bay and thus essentially in a direction lying transversely at 45° to the direction of transport 5. In order to make this possible using a belt drive, two deflection rollers 18 and 19 are provided. These are disposed in free-running manner on the top or bottom side of a bearing block 20, which is joined laterally to the supporting member 8 between its middle section 9 and the bearing eye 10.

The vane-wheel 12 is powered by this belt drive, formed from the contact pressure roller 16, the power take-off roller 14 and the drive belt 15, in anti-clockwise direction, so that the rotational movement of its vanes 13 points in the direction of the corner formed

by the front wall 1 and the one side wall 2 of the delivery bay. The vanes 13 act as alignment elements for the recording carriers 4 to be stacked and, in the activated state of the alignment unit 6, come into frictional contact with the incoming recording carrier 4, pulling the gripped surface of the recording carrier in the direction of the assigned corner of the delivery bay, so that it is aligned there.

Now this action upon the recording carrier 4 must only take place in the activated state of the alignment unit 6. In order to enable this, the latter is pivotably disposed on the drive shaft 7 so that the vanes 13 of the vane-wheel 12 acting as a feed element do not, in the swivelled-out state of the alignment unit 6, come into contact with recording carriers 4 feeding into the depositing bay.

In order to create this swivel movement of the alignment unit 6, a further shaft, configured as a control shaft 21, is provided parallel to the drive shaft 7. This control shaft 21 lies approximately concentric to the fork 11 of the supporting members 8 of the alignment units 6 and exhibits, in the area of these forks, eccentric rollers 22, which are rigidly coupled to the control shaft and are disposed, in relation to the two alignment units 6, opposingly on the control shaft 21. This means that, upon rotation of the control shaft 21, the supporting members 8 of the two alignment units 6 perform opposite-working rocking movements.

Where, for example, in an angled position of the control shaft 21, the alignment unit 6 represented on the left in Fig. 1 is in the operating position, i.e. this alignment unit is in frictional contact with the incoming recording carriers 4, then the other alignment unit 6, represented on the right, is disengaged from the recording carriers 4. If the control shaft 21 is rotated through 180°, then the functioning of the alignment units 6 changes over. The previously activated alignment unit 6 then circulates freely, whilst the other, previously

inactive alignment unit then pushes the recording carriers 4 into the opposite-facing corner of the delivery bay.

Fig. 1 indicates that a plurality of eccentric rollers 22 are assigned to the alignment unit 6 represented on the left in Fig. 1. The reason for this measure can be found in the fact that the delivery bay formed from the front wall 1 and the side walls 2 or 3 is intended to be adjustable to different sizes of recording carriers 4 to be stacked. For this purpose, it is assumed that the second side wall 3 is configured such that it is displaceable in terms of its distance to the opposite-facing side wall 2. In order now to ensure an exact alignment of the recording carriers 4 in the corner of the delivery bay formed by the front wall 1 and this displaceable side wall 3, the assigned alignment unit 6 - represented on the left in Fig. 1 - must also be laterally displaceable, as is diagrammatically indicated by a further arrow 23.

The reason for the profile of the drive shaft 7 also thereby becomes clear. Upon the axial displacement of the alignment unit 6 disposed on the left in Fig. 1, its drive roller 16 of the belt drive is simultaneously displaced, without the functional coupling to the drive shaft being impaired. As indicated in Fig. 1, there is attached to the displaceable alignment unit 6 a pushrod 24, by which, when setting the adjustable side wall 3 to a different size of recording carriers 4, the alignment unit represented on the left in Fig. 1 can also be accordingly axially displaced.

The illustrative embodiment described illustrates that it is possible, using identically configured alignment units disposed in mirror symmetry to one another, to stack recording carriers 4 feeding into the delivery bay optionally flush with the right-hand side wall or with the left-hand side wall of the delivery bay. Following the above-stated explanation, it is clear to a person skilled in the art that the control shaft 21 can be

assigned a drive system which is regulated by output signals of the printer control system of a printing device. Thus, one of the two alignment units 6 is activated reciprocally in order thereby to stack the respectively incoming recording carriers 4 in left or right-flushing arrangement, i.e. laterally offset in relation to one another in the delivery bay.

In the described illustrative embodiment, for the alignment of the recording carriers 4, a vane-wheel 12 having elastically deformable vanes 13 is used as the feed element. This is one of possible embodiments, it being conceivable, in fact, to replace this vane-wheel, by a friction roller or by a different feed element, for example. Nor is it absolutely necessary to control the alignment units by eccentrics: for the design of swivel movements of this type the person skilled in the art also has other options available to him, for example lifting magnets and the like. These examples illustrate that, in the context of the invention, many designs are possible and the invention itself is not limited to this illustrative embodiment.

Patent claims

1. Depositing device for the, optionally laterally offset, stacking of sheet-form recording carriers (4) in a delivery bay (1, 2, 3) of a printing device having side walls (2, 3), the distance between which is greater than the stack width of the recording carriers, using alignment units (6), which are in each case disposed adjacent to the front-face corners of the depositing bay, can be activated alternately and each exhibit a powered feed element (12, 13, 14), which can be brought into frictional contact with an incoming recording carrier and then exerts on the latter a feed force at right angles to its main direction of transport (5) in the direction of the assigned side wall, characterised in that the alignment units are secured, in rotationally movable manner and perpendicular to the surface of the stack of deposited recording carriers (4) and such that they are reciprocally adjustable on different levels, on an axle (7) aligned parallel to the surface of the stacked recording carriers and perpendicular to the side walls of the depositing bay, this axle, as a continuously powered shaft, simultaneously forming a common drive element for the feed elements which are coupled thereto via a gear mechanism (14, 15, 16).

2. Depositing device according to Claim 1, characterised in that each alignment unit (6) exhibits a supporting member (8), which is mounted in rotatably movable manner and having a bearing eye (10) on the axle (7) and to which, in each case, the feed element (12, 13, 14) is secured in rotatably movable manner, and in that on the supporting member (8) there are provided engaging selecting means (21, 22), which reciprocally and optionally lower the feed elements onto or raise them from the surface of the stack of deposited recording carriers (4).

3. Depositing device according to Claim 2, characterised in that, as selecting, means eccentric rollers

(22) are provided, which are disposed in counter direction to the alignment units (6) and are rigidly secured on a common control shaft (21) aligned parallel to the drive axle (7) and each reciprocally activate or deactivate one of the alignment units (6).

4. Depositing device according to Claim 3, characterised in that the supporting member (8) of the alignment units (6) exhibits, at its end furthest from the bearing eye (10) and pointing in the direction of the front wall (1) of the delivery bay, a U-shape configured fork (11), between which one of the eccentric rollers (22) is disposed.

5. Depositing device according to Claim 4, characterised in that the supporting member (8) is configured cranked in such a way that a middle section (9) connecting the bearing eye (10) and the fork (11) points, when the supporting member is in the fitted state, at right angles to the direction of transport (5) of the recording carriers (4) in the direction of the corner between the assigned side and front walls (2, 3 or 1) of the delivery bay.

6. Depositing device according to Claim 5, characterised in that the feed element (12, 13, 14) is secured to the middle section (9) of the supporting member (8) and is configured as a powered rotational member.

7. Depositing device according to Claim 5, characterised in that the feed element is disposed in rotatably movable manner on the middle section (9) of the supporting member (8) and is configured as a vane-wheel (12), which exhibits a plurality of elastically configured vanes (13) which are regularly distributed on its periphery and protrude in radial direction.

8. Depositing device according to one of Claims 1 to 7, characterised in that the gear mechanism of the feed element (12, 13) is configured as a belt drive, having a drive roller (16) coupled to the drive shaft (7), a power take-off roller (14) rigidly coupled to the feed element (12, 13) and a circulating, self-enclosed drive belt

(15).

9. Depositing device according to Claim 8, characterised in that two free-running deflection rollers (18, 19) for the drive belt (15) are additionally disposed on the supporting member (8).

10. Depositing device according to one of Claims 1 to 9, having a delivery bay in which at least one side wall (3) is laterally adjustable for adaptation to different sizes of recording carriers (4), characterised in that the alignment unit (6) assigned to the adjustable side wall (3) is also displaceably disposed on the axle (7).

11. Depositing device according to one of Claims 8 or 9, having a delivery bay in which at least one side wall is adjustably configured for adaptation to different sizes of recording carriers, characterised in that the drive shaft (7) is equipped with an edge profile on which the bearing eyes (10) of the supporting members (8) are disposed in free-running manner and the drive rollers (16) of the alignment units (6) are coupled in positive-locking manner in the direction of rotation but are displaceably disposed in the direction of the axle.

12. Depositing device according to one of Claims 10 or 11, characterised in that, for the manual adjustment of the axially movable alignment unit (6), a pushrod (24) is provided, which is disposed parallel to the drive shaft (7) and is attached to the axially movable alignment unit.

Reference symbol list

1	front wall of the delivery bay
2, 3	side walls of the delivery bay
4	sheet-form recording carriers
5	direction of transport of the recording carriers
6	alignment units
7	drive shaft (axle)
8	supporting member
9	middle section of 8
10	bearing eye of 8
11	U-shaped fork of 8
12	vane-wheel
13	vane of 12
14	power take-off roller of 12
15	drive belt
16	drive roller
17	arrow for direction of rotation of 7
18,19	deflecting rollers
20	bearing block
21	control shaft
22	eccentric rollers
23	arrow for direction of sliding of 6
24	pushrod

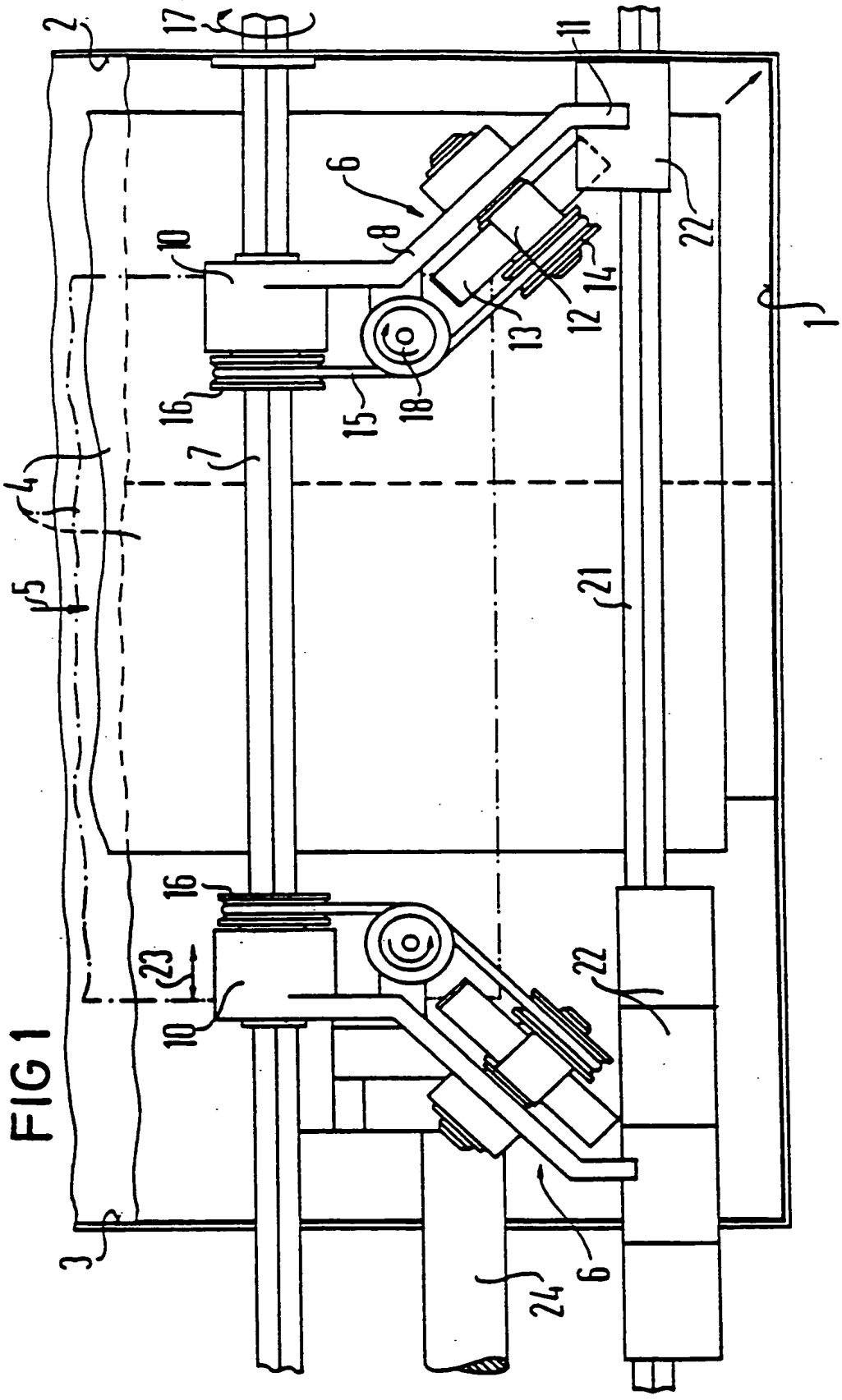

FIG 1

FIG 2